Two new species and new records of biting midges of the genus *Culicoides* from northwestern Argentina (Diptera: Ceratopogonidae)

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The following two new species of Culicoides *from the Argentinean Yungas are described, illustrated and placed to subgenus or species group and compared with related congeners*: Culicoides calchaqui *Spinelli & Veggiani Aybar and* Culicoides willinki *Spinelli & Veggiani Aybar*. Culicoides daedaloides *Wirth & Blanton is recorded for the first time for Argentina and* Culicoides pseudoheliconiae *Felippe-Bauer is firstly mentioned from the northwestern region of the country.*

Key words: *Culicoides* - *C. calchaqui* sp. nov. - *C. willinki* sp. nov. - new records - Yungas - Argentina

The genus *Culicoides* is by far the most notorious of the 109 extant genera of Ceratopogonidae. Not only is it the most diverse in the family, with 1,366 named species (Borkent 2012), but members occur virtually throughout the terrestrial world, from the tropics to far southern and northern areas, from coastal areas to very high altitudes (up to 4,200 m) (Spinelli & Borkent 2004). Many species in the genus are miserable pests of humans and domestic animals, acting as vectors of a variety of diseases summarised by Borkent and Spinelli (2007). Of the 280 currently recognised Neotropical species, 42 inhabit Argentina and three more are known to occur in bordering sites of Uruguay and Paraguay.

The study of *Culicoides* specimens collected by researchers of the Institute of Entomology Dr Abraham Willink, Tucumán, Argentina, in the Yungas of northwestern Argentina, revealed the presence of two new species and an additional two species not recorded yet in the area. The purpose of this paper is to provide the descriptions and records of this material.

MATERIALS AND METHODS

All specimens, mounted on microscope slides in Canada balsam, were examined and measured with a binocular compound microscope at 40-400X. Photographs were taken with a digital camera Micrometrics SE Premium through a Nikon Eclipse E200 binocular microscope.

Terms for structures follow those used in the Manual of Central America Diptera (Brown et al. 2009). Names of veins are always in upper case and those of cells in lower case. Pale areas in cell r_3 posterior to or immediately distal to the second radial cell are called poststigmatic pale spots. Ratios used follow Spinelli and Borkent (2004).

Specimens are deposited in the collections of the Institute-Foundation Miguel Lillo (IFML), San Miguel de Tucumán, Argentina, and a paratype of *C. calchaqui* in the La Plata Museum (MLP), La Plata, Argentina.

RESULTS

Culicoides (Hoffmania) calchaqui
Spinelli & Veggiani Aybar, sp. nov.
(Figs 1-4)

Diagnosis - Only Neotropical species in the *guttatus* species group with slender third palpal segment bearing subdivided pit, crossvein r-m faintly darkened anteriorly, R_3 faintly darkened up to the point where it turns abruptly forward to meet costa, two distal pale spots in m_1, apical one faint, distal pale spot in m_2 small and barely abutting wing margin, pale spot in cua_1 small and separated from pale line bordering lower margin of CuA_1 and apex of CuA_2 dark.

Female - Head (Fig. 1): dark brown. Eyes bare, contiguous by distance equal to diameter of two ommatidia. Flagellum brown, bases of flagellomeres pale; AR 1.08-1.14 (1.11, n = 3); sensilla coeloconica on flagellomeres 1, 9-13. Palpus (Fig. 2) dark brown; segment 3 elongate, slender, slightly swollen at midlength, with subdivided pit, long slender portion beyond pit; PR 3.60-3.84 (3.64, n = 3); P/H ratio 1.03-1.11 (1.06, n = 3). Mandible with 17-19 (n = 3) teeth.

Thorax: uniformly dark brown. Legs dark brown; fore, mid knees, broad base and apex of hind tibia pale; hind tibial comb with six spines, second from spur longest. Wing (Fig. 3) length 1.23-1.58 (1.39, n = 3) mm; width 0.55-0.65 (0.60, n = 3) mm; CR 0.66-0.69 (0.68, n = 3); with contrasting pattern; crossvein r-m faintly darkened anteriorly; most of second radial cell in pale spot; R_3 faintly darkened up to the point where it turns abruptly forward to meet costa; distal pale spot in r_3 transverse, reniform, barely abutting wing margin; M_2 straddled by pale spot nearly its midlength; two distal

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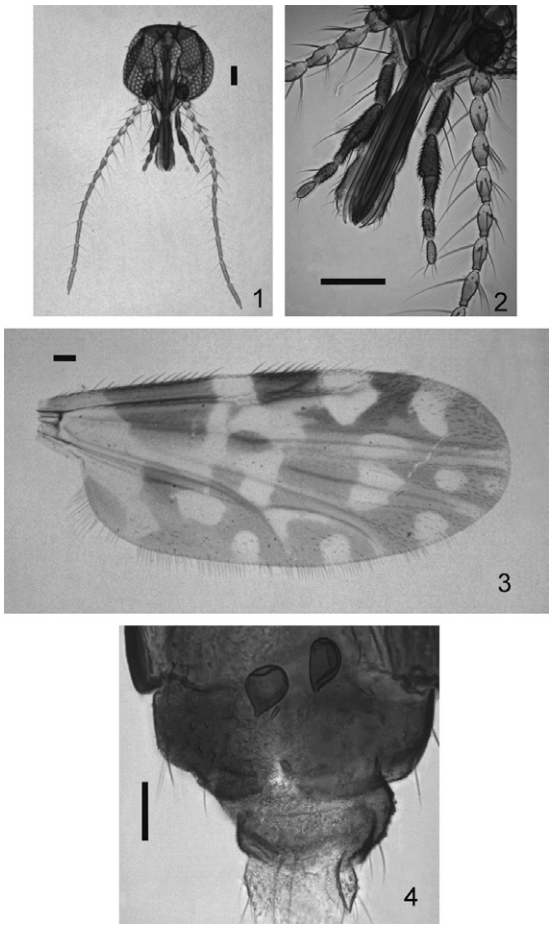
pale spots in m_1, apical one faint, abutting wing margin; distal pale spot in m_2 small, rounded, barely abutting wing margin; pale spot in cua_1 small, rounded, separated from pale line bordering lower margin of CuA_1; anal cell with two basal, two distal pale spots; apices of M_1, M_2, CuA_1 with small pale spot, apex of CuA_2 dark; pale spot posterior to medial fork broadly connected with pale spot lying anterior to cubital fork. Macrotrichia scattered on distal fourth of wing, also present in cua_1, anal cell. Halter brown.

Abdomen: dark brown. Two ovoid spermathecae without short necks (Fig. 4), measuring 58-66 (62, n = 2) by 41-43 (42, n = 2) μ and 41-65 (53, n = 2) by 35-43 (39, n = 2) μ; rudimentary third, ring present.

Male - Unknown.

Type data and depository - Holotype, Argentina, Tucumán, Lules, Potrero de las Tablas, 22-IV-2008, C. Veggiani Aybar, CDC light trap with CO_2 (IFML).

Other material examined - Two female paratypes, as follows: same data as holotype, 1 female; Tucumán, Chicligasta, El Molino, 23-X-2010, 1 female, ultraviolet light trap (MLP).



Figs 1-4: *Culicoides calchaqui*, female. 1: head; 2: palpus; 3: wing; 4: tip of abdomen, showing spermathecae. Bars = 0.05 mm.

Distribution - Argentina (Tucumán).

Etymology - The species name is a reference to the Calchaquí Indians, early inhabitants of the type-locality and surrounding area.

Taxonomic discussion - *C. calchaqui* is a member of the *guttatus* species group within the subgenus *Hoffmania* Fox. It keys out in the Spinelli et al. (1993) revision of the Neotropical species of the *guttatus* group to the couplet 29 and would run to *Culicoides ignacioi* Forattini from southeastern Brazil and Paraguay and *Culicoides paraignacioi* Spinelli from Belize to Perú, French Guiana and Brazilian Amazonia. However, *C. ignacioi* is a much darker species, the third palpal segment is stouter in mid portion and the distal extension beyond the irregular pit is distinctly shorter, the mandible is armed with 20-22 teeth, the wing pattern is deeply contrasting, the crossvein r-m is heavily dark anteriorly, the R_3 is completely pale and the apical pale spot in cell m_1 is well defined and broadly abuts the wing margin. *C. paraignacioi* is a smaller species, its third palpal segment is more slender with a definite, rounded and shallow sensory pit, the mandible bears 21-23 teeth, the crossvein r-m is heavily dark anteriorly and the macrotrichia in cell cua_1 and anal cell is restricted to the wing margin.

It also keys out in the Spinelli et al. (2005) revision of bloodsucking biting midges of Argentina to the couplet 24, but in this new species the vein R_3 is not pale, but darkened up to the point where it turns abruptly forward to meet the costa and lacks the distinct black spot just beyond apex.

This new species is also very similar to *Culicoides annettae* from Costa Rica (Spinelli & Borkent 2004), but the latter species is smaller (wing length 0.94-1.14 mm), the r-m crossvein and vein R_3 are not faintly darkened, the distal pale spot in cell m_2 is larger and broadly abuts the wing margin, the pale spot in cell cua_1 is connected with the pale line that borders lower margin of vein CuA_1 and the apex of vein CuA_2 is included in a small pale spot.

Culicoides willinki Spinelli & Veggiani Aybar, sp. nov. (Figs 5-12)

Diagnosis - Only species in the *limai* species group with poststigmatic pale spots L-shaped nearly isolating a small dark spot at tip of second radial cell, distal pale spots in r_3 and m_1 small and separated from wing margin and macrotrichia mainly present marginally. Male tergite 9 with minute apicolateral processes, parameres without ventral lobe and aedeagus Y-shaped with distal portion slender, tapering to blunt tip flanked by prominent pair of slender pointed processes which borne distally in the basal arch.

Male - Similar to female with usual sexual differences. Wing length 0.70 mm; width 0.32 mm; CR 0.57. Genitalia (Figs 5, 6): tergite 9 broad, tapering, distal margin with distinct median notch, apicolateral processes minute; sternite 9 with moderate posteromedian, rounded excavation. Gonocoxite elongate, 2.3 X longer than greatest breadth, ventral root slender, foot-shaped, dorsal root slender, pointed; gonostylus 0.8 X longer than gonocoxite, curved, tip pointed. Parameres (Fig. 5) separate, each with sclerotised basal knob, stem sinuose

without ventral lobe, tapering to fine point with sublateral barbs. Aedeagus (Fig. 6) Y-shaped, lateral arms strongly sclerotised; basal arch triangular, extending 2/3 of total length; distal portion slender, tapering to blunt tip flanked by prominent pair of slender pointed processes which borne distally in the basal arch.

Female - Head (Fig. 7): dark brown. Eyes bare, very narrowly separated. Flagellum pale brown; flagellomeres 2-8 vasiform, 9-13 subcylindrical; AR 0.94; sensilla coeloconica on flagellomeres 1, 5-8. Palpus (Fig. 8) brown, segment 3 swollen up to apex, with broad, shallow subapical pit; PR 1.73; P/H ratio 0.74. Mandible with 14 teeth.

Thorax: scutum (Fig. 9) dark brown with two elongate, anterior, submedian yellowish patches, two pairs of anterolateral small spots; scutellum narrowly dark brown mesally, pale on sides. Legs (Fig. 10) dark brown; tibiae with subbasal pale rings, broad apex of hind tibia pale, fore and midfemora with subapical pale rings; hind tibial comb with four spines, one nearest spur longest. Wing (Fig. 11) length 0.79 mm; width 0.38 mm; CR 0.59; second radial cell, distal third of first radial cell in dark spot; pale spot over r-m crossvein broadly abutting wing margin; poststigmatic pale spots in r_3 fused, L-shaped, nearly isolating a small dark spot at tip of second radial cell; distal pale in r_3 small, not abutting anterior wing margin; m_1 with two small pale spots, distal one well separated from wing margin; m_2 with two distal pale spots, most distal one small, rounded, barely abutting wing margin; cua_1 with rounded pale spot broadly abutting wing margin and distal half of CuA_1; anal cell with two large distal pale spots; m_2 with pale spot behind medial fork. Scattered macrotrichia only present marginally along entire wing, few accompanying distal fourth of M_1, M_2. Halter pale brown.

Abdomen: brown, slightly darker at tip. Two subequal spermathecae, partially collapsed in the available specimen, necks moderately long (Fig. 12), each measuring 45 by 30 μ, neck 8 μ; rudimentary third, ring present.

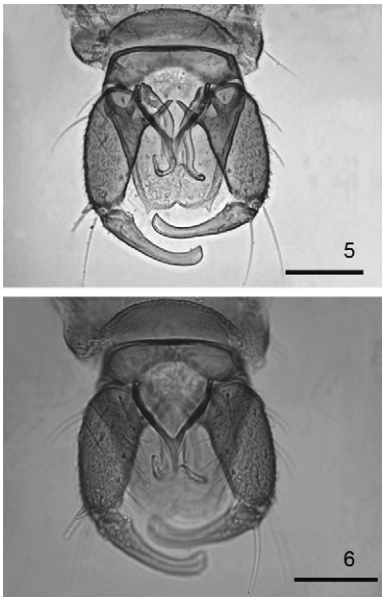
Type data and depository - Holotype male, Argentina, Tucumán, Monteros, Reserva provincial La Florida, 04-XI-2005, MJ Dantur Juri, CDC light trap with CO_2 (IFML).

Other material examined - One female paratype, same data as holotype.

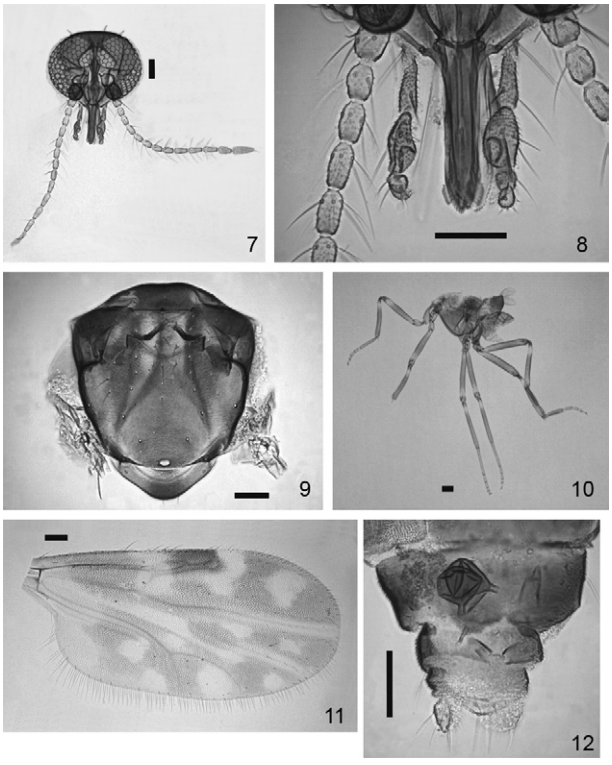
Distribution - Argentina, known only from the type-locality in Tucumán.

Etymology - We are pleased to name this species after the late Dr Abraham Willink, teacher and advisor of many Argentinean entomologists working at the Institute of Entomology, College of Natural Sciences and IFML.

Taxonomic discussion - This new species belongs to the *limai* species group. It keys out in Spinelli et al. (2005) to the couplet 38 and would run to *Culicoides limai* Barretto from El Salvador to northeastern Argentina and *Culicoides boliviensis* Spinelli and Wirth from Bolivia, southern Brazil and northeastern Argentina. However, these two species lack the small, isolated dark spot at tip of second radial cell within the fused poststigmatic pale spots and as it is common in the majority of the members of the *limai* group, the pale



Figs 5, 6: *Culicoides willinki*, male; 5: genitalia (dorsal view); 6: genitalia (ventral view). Bars = 0.05 mm.



Figs 7-12: *Culicoides willinki*, female; 7: head; 8: palpus; 9: scutum and scutellum; 10: legs; 11: wing; 12: tip of abdomen, showing spermathecae. Bars = 0.05 mm.

areas in cells r_3, m_1, m_2 and cua_1 are very extensive and the distal ones broadly abut the wing margin. The male genitalia of *C. limai* differs from *C. willinki* by the larger apicolateral processes, by the distinct ventral lobe of the paramere stem and by the aedeagus with rounded basal arch lacking the pair of prominent, slender and pointed processes that flank the aedeagus tip. The male of *C. boliviensis* is unknown.

Culicoides santanderi Browne from Colombia is also similar to *C. willinki* by virtue of the pale areas in the wing not so extensive and by the presence of a small, isolated dark spot at tip of second radial, but in this species the distal pale spots in cells r_3, m_1, m_2 also abut the wing margin (very narrowly in m_1), the halter is pale and the hind tibia exhibits a subapical pale ring.

New records

C. daedaloides Wirth & Blanton
(*daedalus* species group)

C. daedaloides Wirth & Blanton (1959): 330 (male, female; Panama); Wirth (1974): 37 [in catalog south to the United States of America (USA)]; Barreto (1986): 149 (Colombia record); Wirth et al. (1988): 28 (numerical characters; wing photo; distr.); Borkent and Wirth (1997): 66 (in World catalog); Borkent and Spinelli (2000): 38 (in catalog south to the USA); Borkent and Spinelli (2007): 71 (in Neotropical catalog); Borkent (2012): 79 (in World catalog).

New record from Argentina - Argentina, Salta, Orán, Aguas Blancas, 13-III-2004, MJ Dantur Juri, two females, CDC light trap with CO_2 (IFML).

Distribution - Panamá, Colombia, northwestern Argentina.

Culicoides (Hoffmania) pseudoheliconiae
Felippe-Bauer (*hylas* species group)

C. pseudoheliconiae Felippe-Bauer, in Felippe-Bauer et al. (2008): 260 (female; Peru); Felippe-Bauer et al. (2009): 852, 856 (in key *hylas* group; Argentina record, Puerto Iguazú); Borkent (2012): 96 (in World catalog).

New record from northwestern Argentina - Argentina, Tucumán, Monteros, Reserva provincial La Florida, 04-XI-2005, MJ Dantur Juri, three females, CDC light trap with CO_2 (IFML).

Distribution - Peru and northern Argentina.

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